

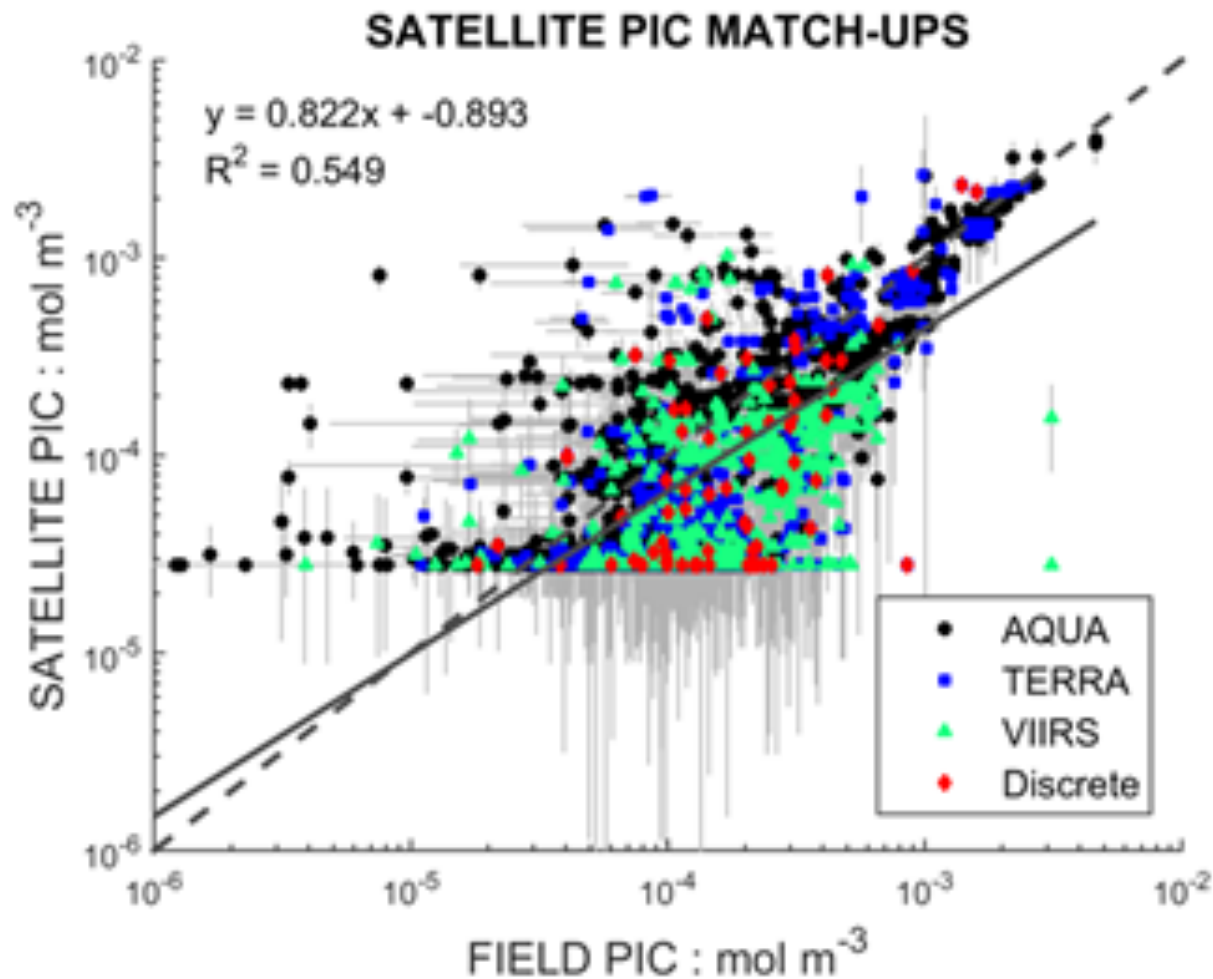
Ocean break-out
Current advances (and challenges)
with the PIC algorithm

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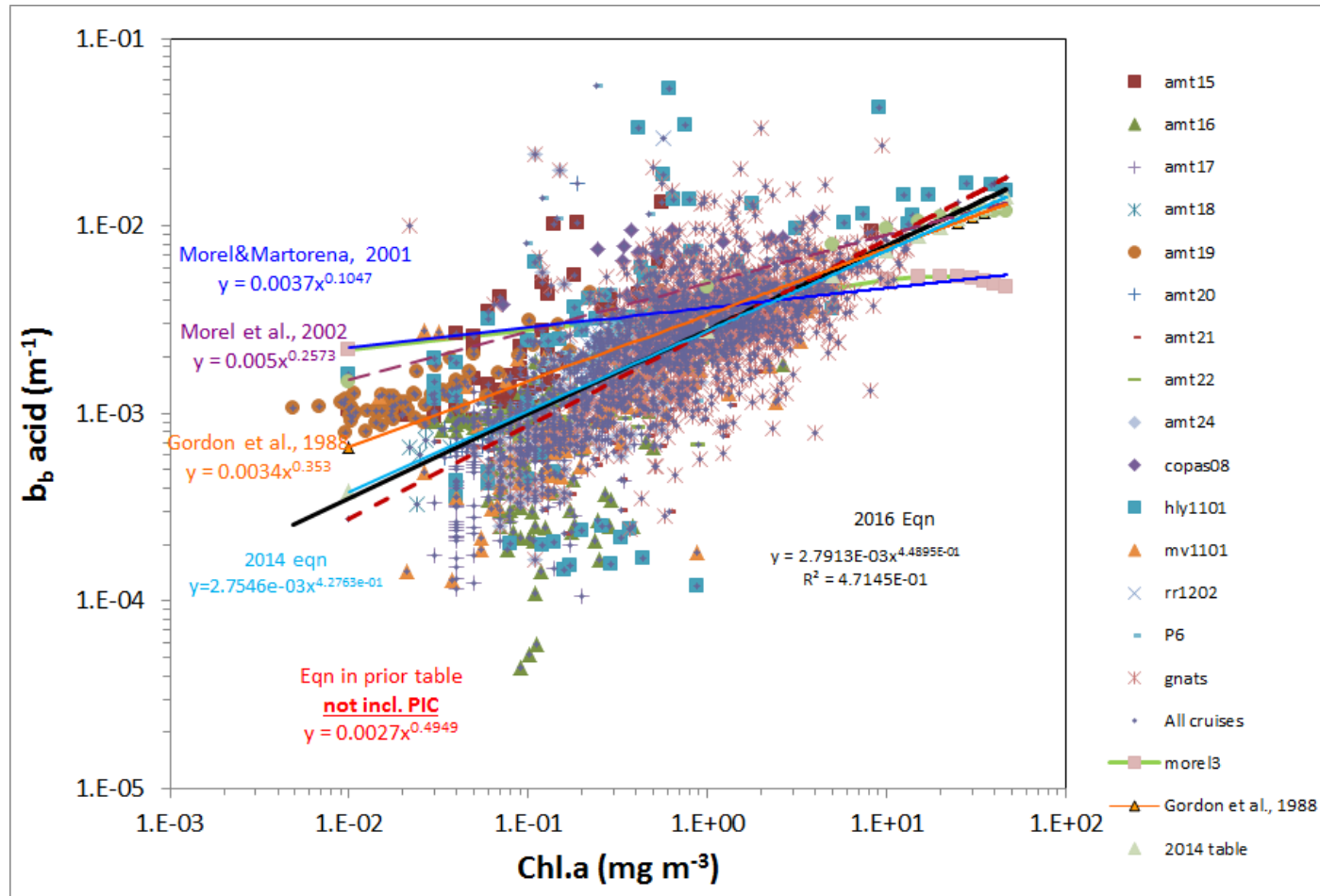
Current status of the 2-band/3-band PIC algorithm

- PIC retrievals by VIIRS and MODIS are similar, except VIIRS has not been validated in any large, high concentration blooms
- Latest processing, incorporating 2015 cruises... algorithm coefficients are further refined but change is incremental

PIC by VIIRS and MODIS



The relation between chl and acid-labile b_{bp531}



A differencing algorithm for PIC

Overview

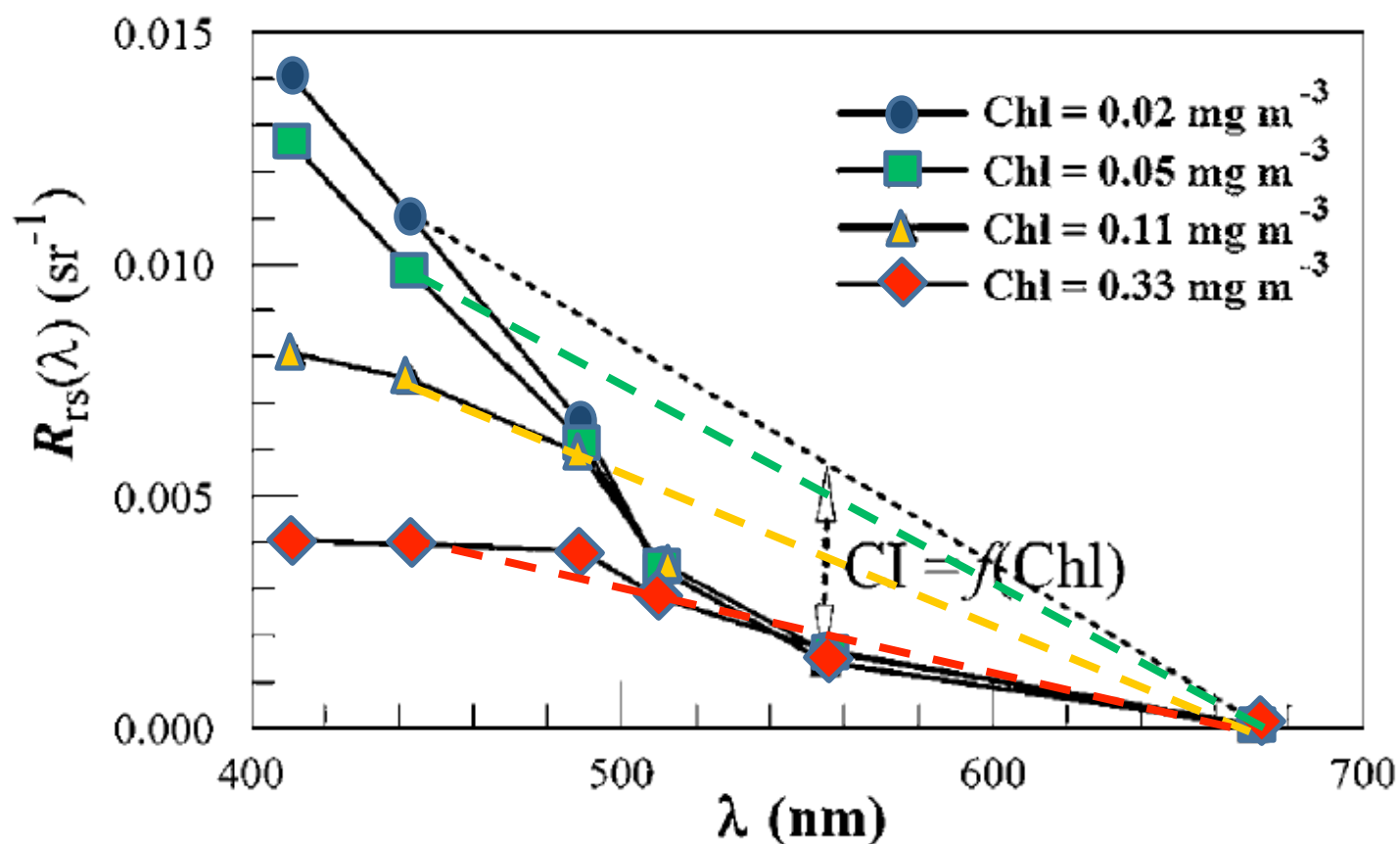
- A new method for estimating particulate inorganic carbon (PIC) concentrations from remote sensing reflectance has been developed.
- Using an extensive global dataset of PIC, the reflectance difference approach of Hu et al. (2012) was applied to derive a relationship between PIC and the color-index (CI), hereafter referred to as the PIC_{CI} algorithm
- The wavelengths used here in deriving the color-index differ from those used in the Hu et al. (2012) chlorophyll (Chl) algorithm to limit the affect of Chl and CDOM:

$$CI = \frac{R_{rs}(\lambda_{l2}) - R_{rs}(\lambda_{l1})}{R_{rs}(\lambda_{l3}) - R_{rs}(\lambda_{l1})} \times \frac{\lambda_{l2} - \lambda_{l1}}{\lambda_{l3} - \lambda_{l1}}$$

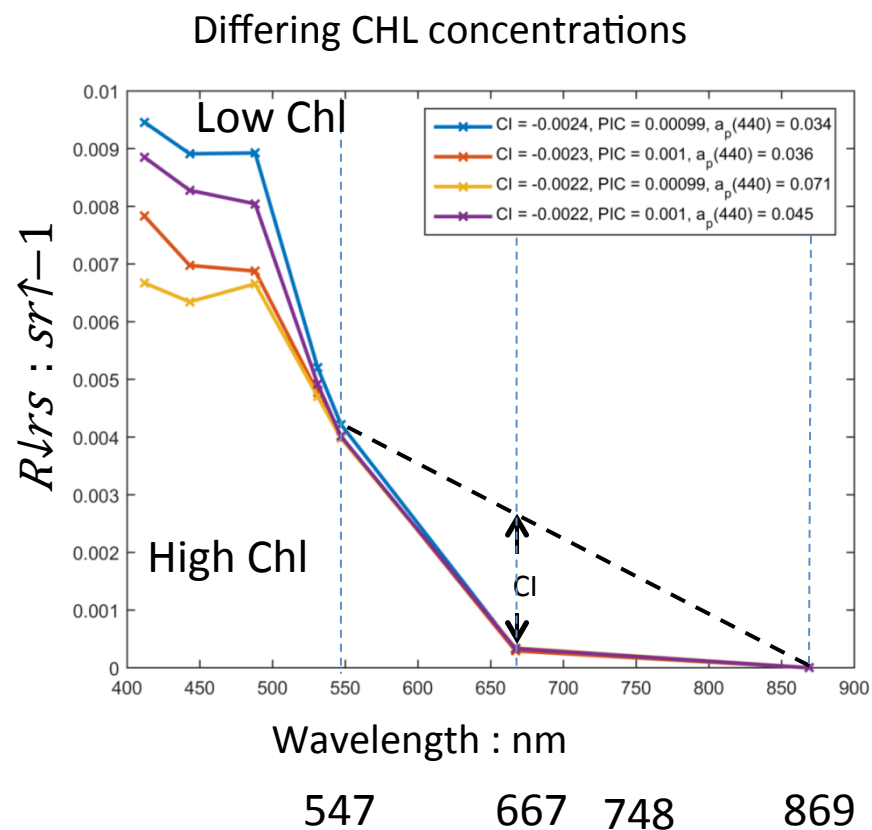
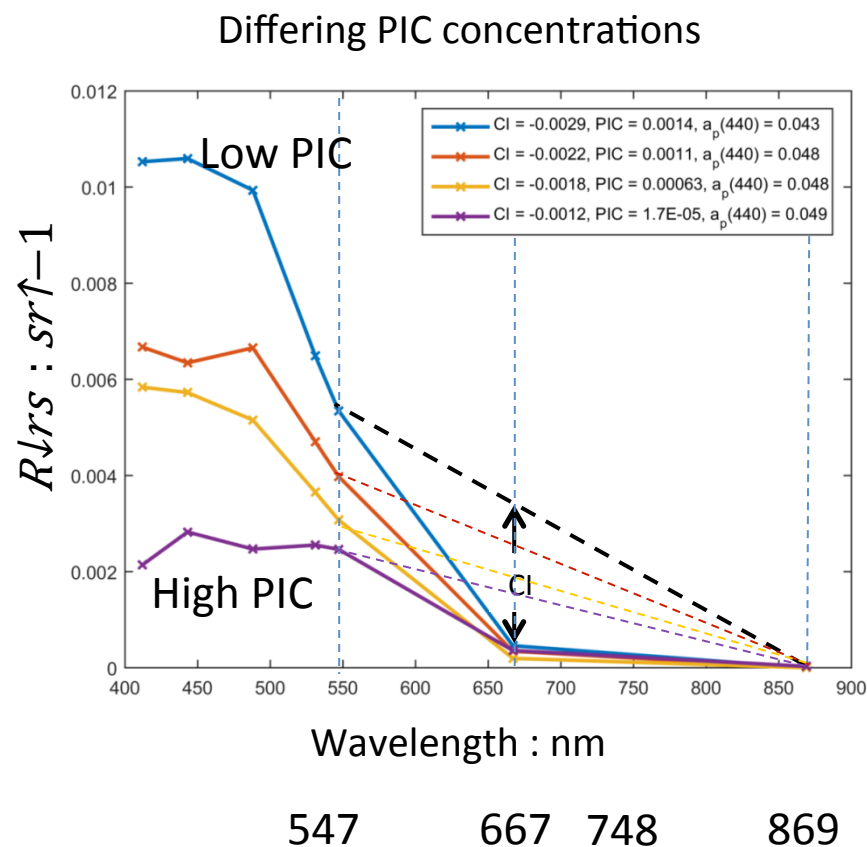
	λ_{l1}	λ_{l2}	λ_{l3}
Hu et al	443	547	667
This study	547	667	869

Chlorophyll *a* algorithms for oligotrophic oceans: A novel approach based on three-band reflectance difference

Chuanmin Hu,¹ Zhongping Lee,² and Bryan Franz³

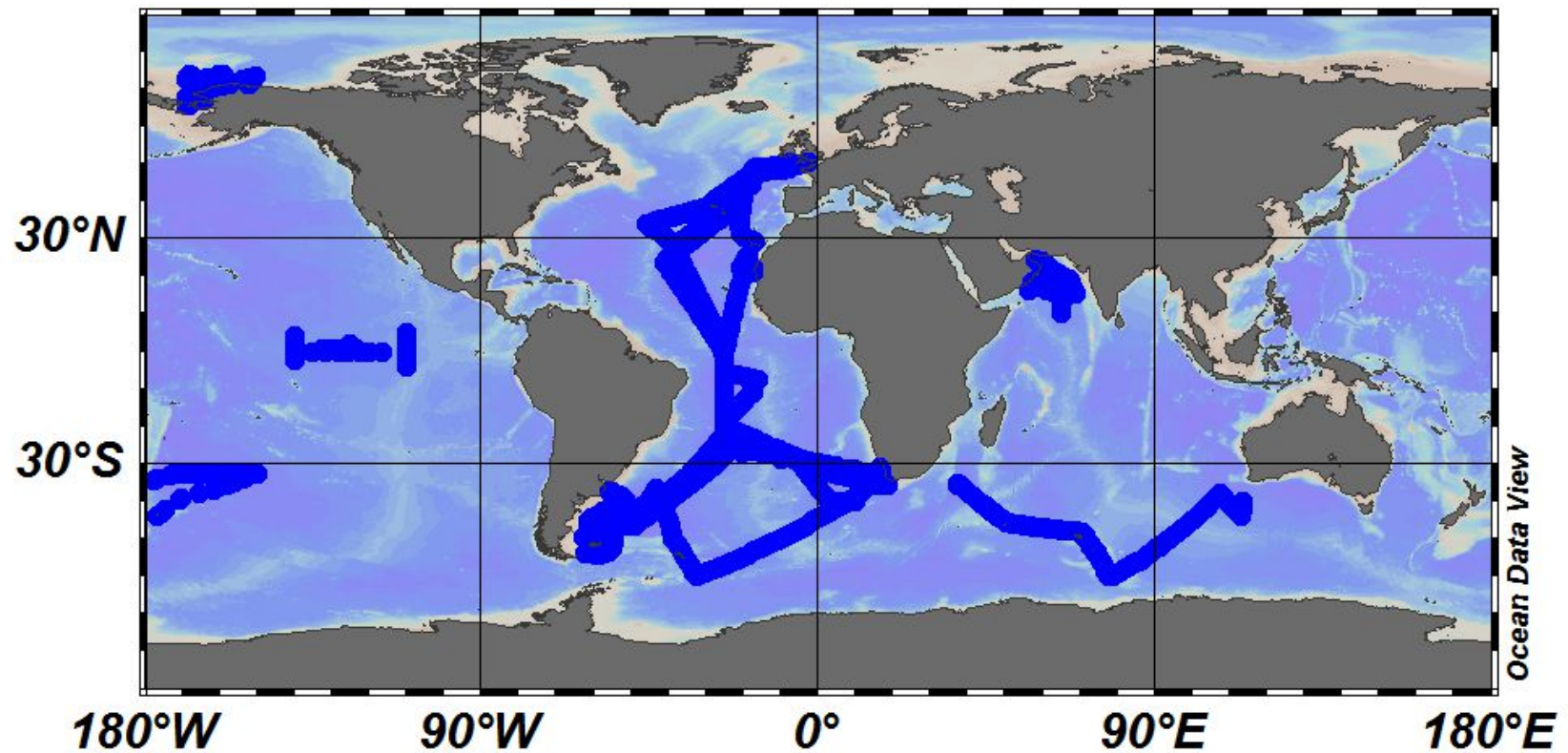


Color Index algorithm for PIC: Proof of concept

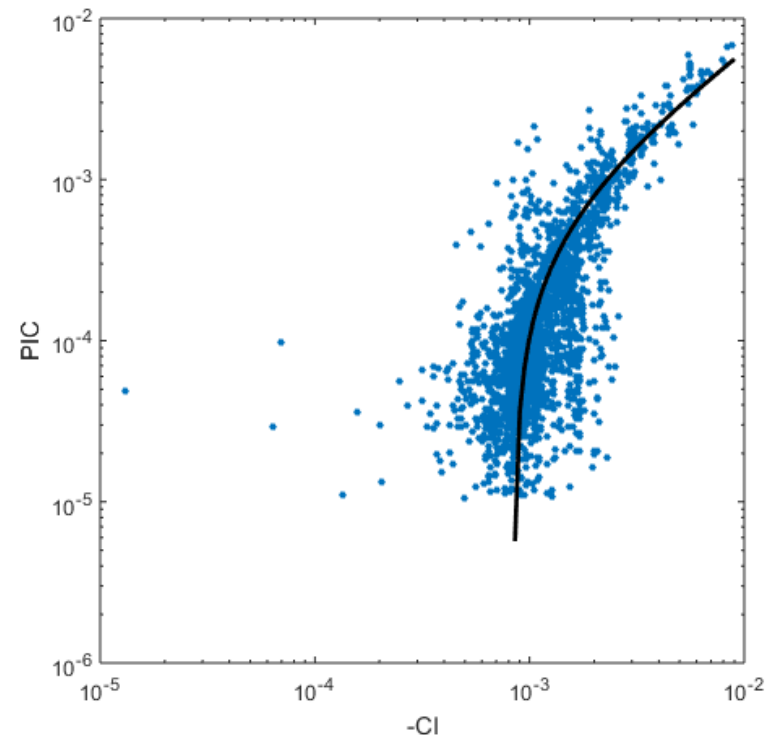
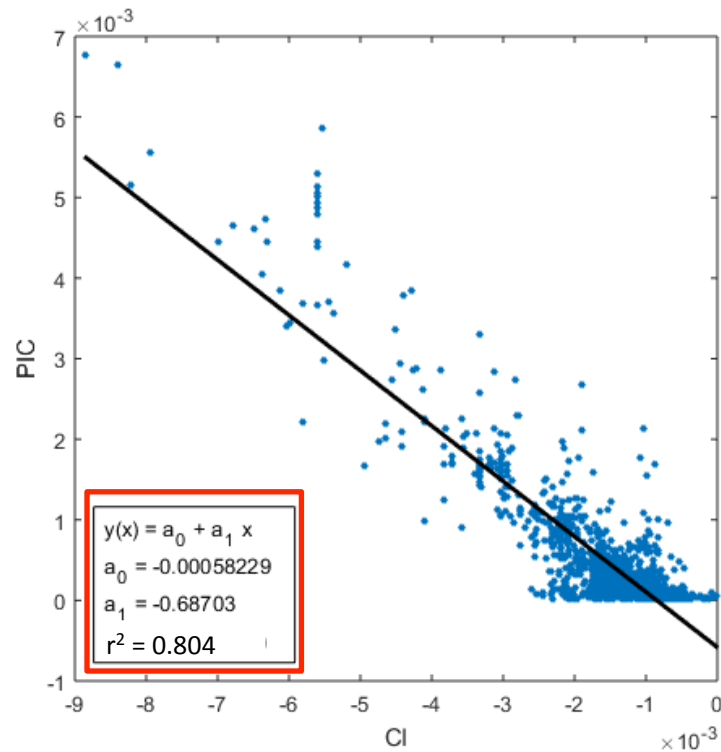


Patagonian Shelf, January 2008

The data set, 15 cruises

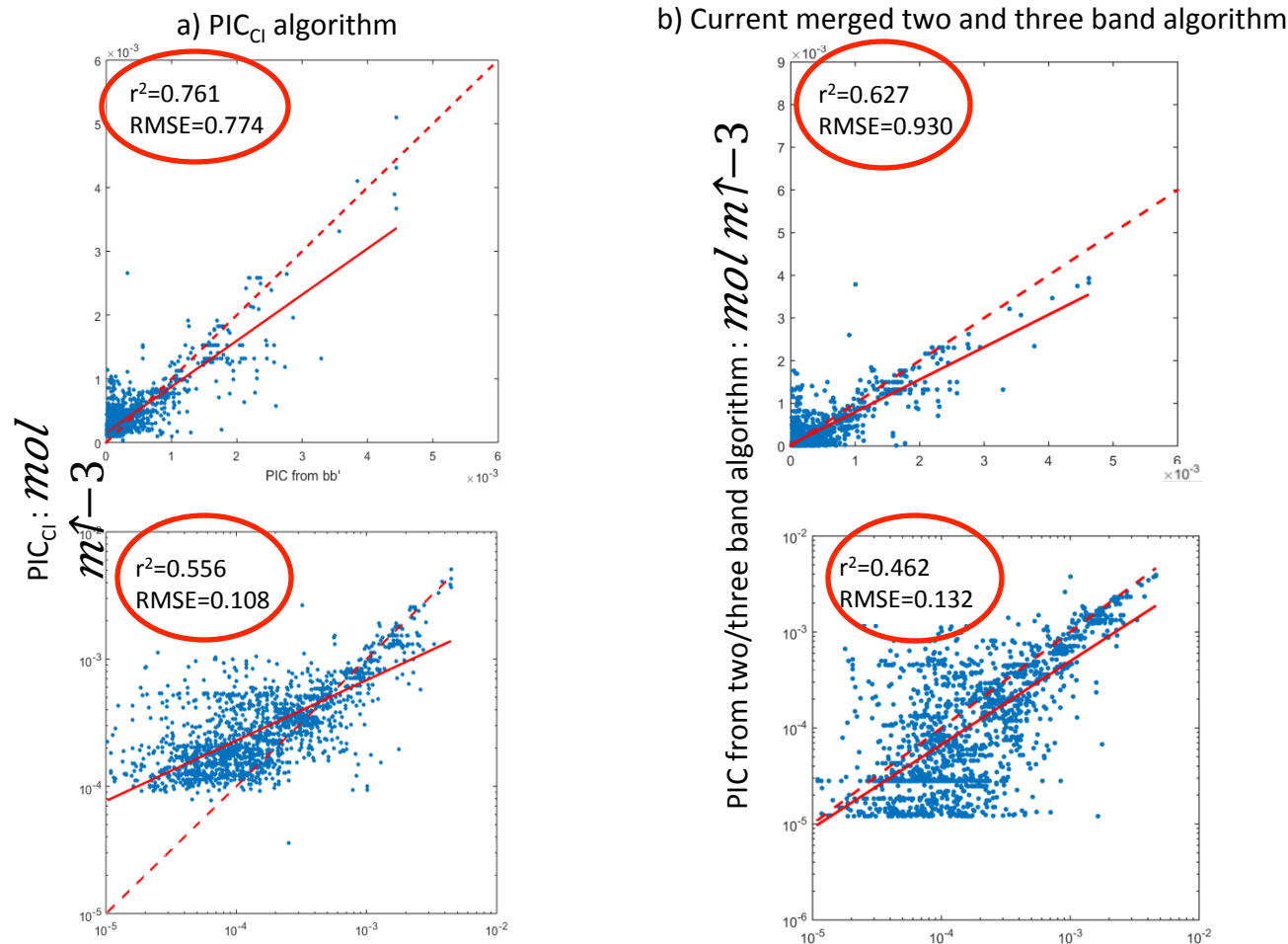


Relationship between PIC and color index



Relationship between field measurements of PIC and CI derived from MODIS Aqua *R_{rs}* data, shown on both a linear (left hand plot) and logarithmic scale (right hand plot)

Validation of PIC_{Cl} algorithm

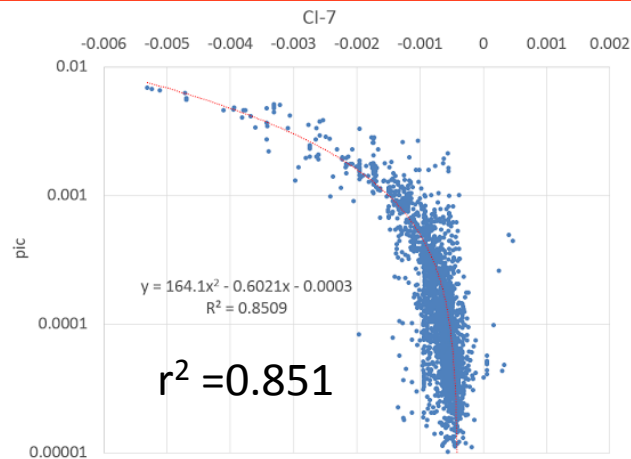
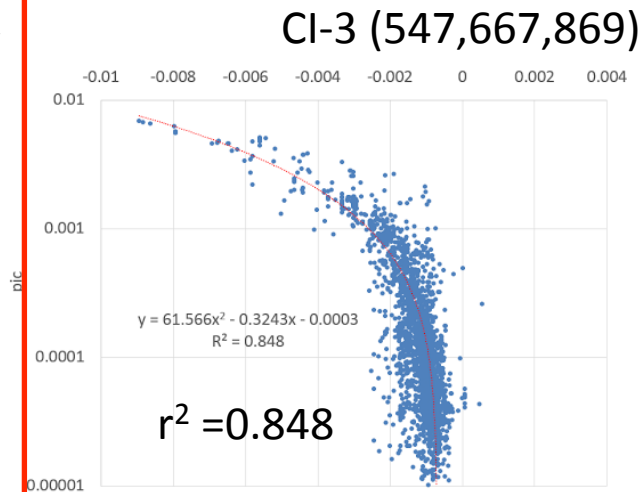
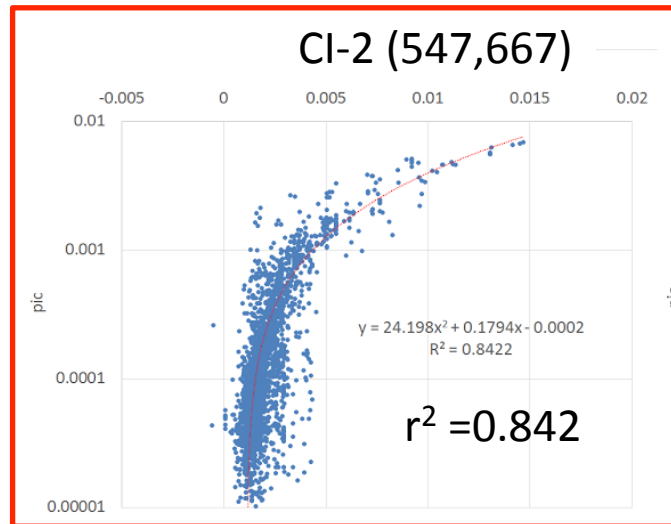


PIC from field measurements : $mol\ m^{-3}$

PIC from field measurements : $mol\ m^{-3}$

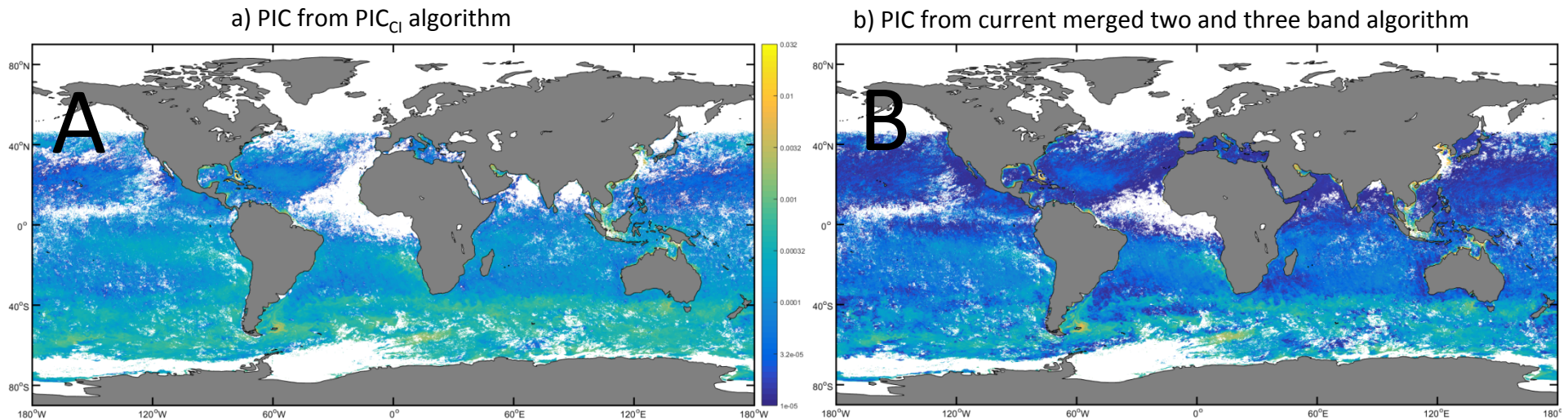
Performance of (a) the PIC_{Cl} algorithm and (b) the current merged two and three band PIC algorithm (Balch et al., 2005 & Gordon et al., 2001), shown in both linear and logarithmic scales

Let's compare three CI-style algorithms: 2-band (547, 667) , 3-band (547, 667, 869) and alternate 3-band (547, 667, 748nm)

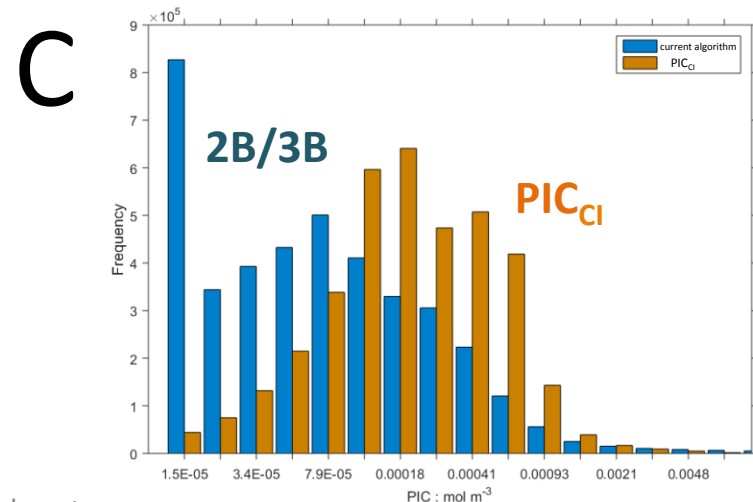


CI-3 (547,667,748)

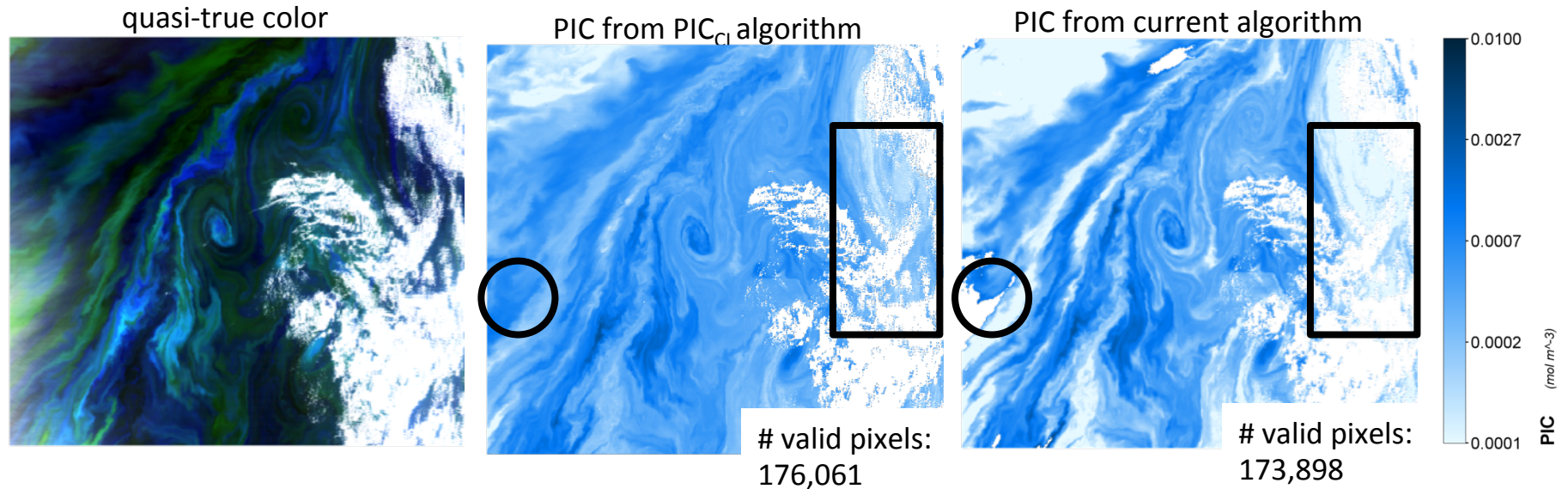
Application to MODIS Aqua data



(a) and (b) Global maps of the average PIC concentration for December 2015 (A and B) and (C) the distribution of the PIC concentration in each of the maps

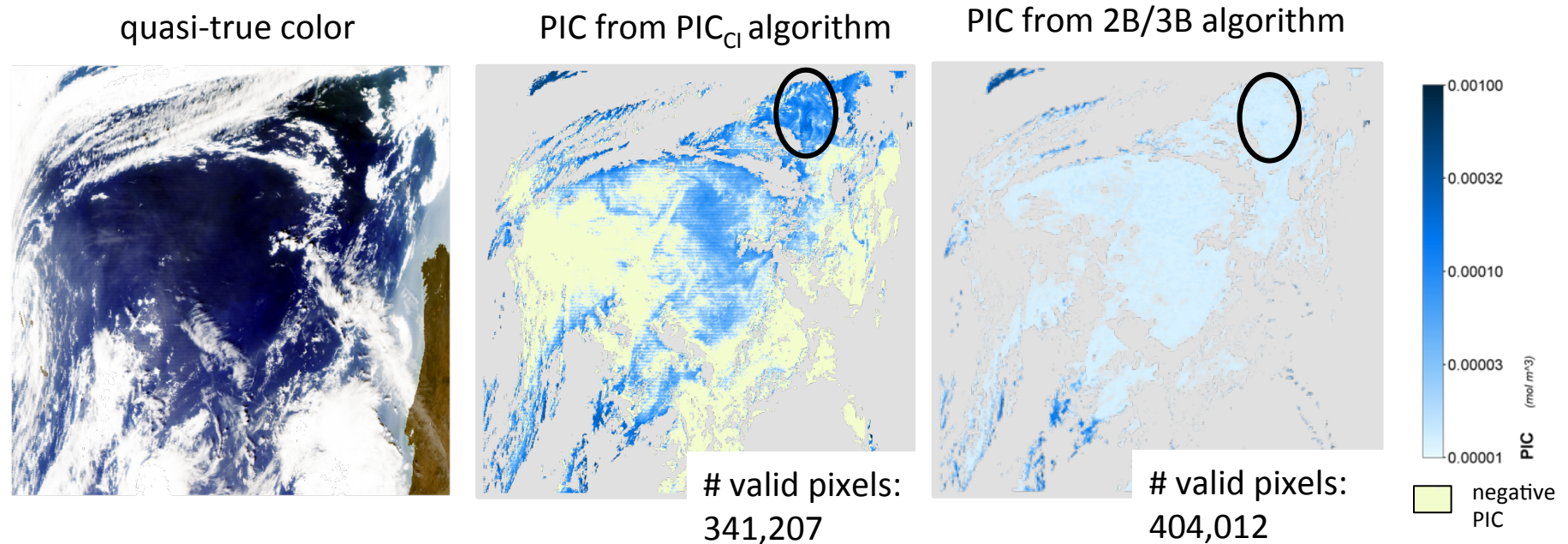


Application to MODIS Aqua data



The Patagonian Shelf, 10th December 2008, with two regions of interest (ROI) highlighted. Both ROIs show areas where the PIC_{Cl} algorithm is more resistant to atmospheric effects than the current algorithm, with less speckling evident in the rectangular ROI and more data recovered in the circular ROI for the PIC_{Cl} algorithm.

Application to MODIS Aqua data



The low CHL Atlantic gyre, 3rd October 2011. The highlighted region shows how more detail is obtained at lower PIC levels with the PIC_{CI} algorithm. The yellow region in the PIC_{CI} algorithm image is where PIC was calculated to be negative.

Conclusions/Summary

- In very clear waters with low R_{rs} signals, PIC from the PIC_{CI} algorithm can be negative, resulting in a reduced number of retrievals.
- There is no hard cut off using the PIC_{CI} algorithm (compared to current algorithm), resulting in a natural lognormal distribution of PIC across the globe, with slightly higher mean value of PIC.
- The PIC_{CI} algorithm is more resistant to atmospheric effects (as evidenced by (i) less speckling and (ii) more data in regions where the 2B/3B algorithm fails).
- Thank you!